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Standard Guide for Development of Fire Hazard Assessment Standards of Electrotechnical Products¹

This standard is issued under the fixed designation D5425; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This guide provides guidance on the development of fire hazard assessment standards for electrotechnical products. For the purposes of this guide, products include materials, components, and end-use products.

1.2 This guide is directed toward development of standards that will provide procedures for assessing fire hazards harmful to people, animals, or property.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This fire standard cannot be used to provide quantitative measures.*

1.5 *This standard is used to predict or provide a quantitative measure of the fire hazard from a specified set of fire conditions involving specific materials, products, or assemblies. This assessment does not necessarily predict the hazard of actual fires which involve conditions other than those assumed in the analysis.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

E1711 Terminology Relating to Electrical Insulation

E176 Terminology of Fire Standards

E603 Guide for Room Fire Experiments

E1546 Guide for Development of Fire-Hazard-Assessment Standards

E1776 Guide for Development of Fire-Risk-Assessment Standards

E2061 Guide for Fire Hazard Assessment of Rail Transportation Vehicles

E2067 Practice for Full-Scale Oxygen Consumption Calorimetry Fire Tests

2.2 NFPA Codes and Standards:³

NFPA 555 Guide on Methods for Decreasing the Probability of Flashover (Withdrawn)

NFPA 556 Guide on Methods for Evaluating Fire Hazard to Occupants of Passenger Road Vehicles

NFPA 901 Uniform Coding for Fire Protection

2.3 International Electrotechnical Commission (IEC) Standards:⁴

IEC 60695-1-1 Fire Hazard Testing—Part 1-1: Guidance for Assessing the Fire Hazard of Electrotechnical Products—General guidelines (Withdrawn)

2.4 International Organization for Standardization (ISO) Standards:⁵

ISO 13943 Fire Safety: Vocabulary

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this guide and associated with electrical and electronic insulating materials, use Terminology **D1711**.

3.1.2 For definitions of terms used in this guide and associated with fire issues, use Terminology **E176**, ISO 13943, and IEC 60695-1-1 (see 5.1). Where differences exist in definitions, the definitions contained in Terminology **E176** shall prevail.

3.2 Definitions of Terms Specific to This Standard:

¹ This guide is under the jurisdiction of ASTM Committee **D09** on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee **D09.17** on Fire and Thermal Properties.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

⁴ Available from International Electrotechnical Commission (IEC), 3 Rue de Varembe, Case postale 131, CH-1211, Geneva 20, Switzerland, <http://www.iec.ch>.

⁵ Available from International Organization for Standardization, P.O. Box 56, CH-1211, Geneva 20, Switzerland or from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

*A Summary of Changes section appears at the end of this standard

3.2.1 *electrotechnical product*, *n*—item that generates or uses electrical power as a source of energy or that is associated with the conduction or transmission of electrical signals or power.

3.2.1.1 *Discussion*—Electrotechnical products include the materials insulating electrical wires and cables and the materials enclosing other products that generate or are fed by electricity, as well as the products themselves and all of their parts.

3.2.2 *fire scenario*, *n*—a detailed description of conditions, including environmental, of one or more of the stages from before ignition to the completion of combustion in an actual fire at specific location, or in a full-scale simulation.

3.2.3 *products*, *n*—material, component, or end-use product.

4. Significance and Use

4.1 This guide is intended for use by those undertaking the development of fire hazard assessment standards for electrotechnical products. Such standards are expected to be useful to manufacturers, architects, specification writers, and authorities having jurisdiction.

4.2 As a guide, this document provides information on an approach to the development of a fire hazard assessment standard; fixed procedures are not established. Any limitations in the availability of data, of appropriate test procedures, of adequate fire models, or in the advancement of scientific knowledge will place significant constraints upon the procedure for the assessment of fire hazard.

4.3 The focus of this guide is on fire assessment standards for electrotechnical products. However, insofar as the concepts in this guide are consistent with those of Guide E1546, the general concepts presented also may be applicable to processes, activities, occupancies, and buildings. Guide E2061 contains an example of how to use information on fire-test-response characteristics of electrotechnical products (electric cables) in a fire hazard assessment for a specific occupancy (rail transportation vehicle).

4.4 A standard developed following this guide should not attempt to set a safety threshold or other pass/fail criteria. Such a standard should specify all steps required to determine fire hazard measures for which safety thresholds or pass/fail criteria can be meaningfully set by authorities having jurisdiction.

5. General Concepts

5.1 It is important to understand and maintain the differences between fire hazard and fire risk.

5.1.1 Fire hazard is defined in Terminology E176 as:

5.1.1.1 *fire hazard*, *n*—the potential for harm associated with fire.

NOTE 1—A fire may pose one or more types of hazard to people, animals, or property. These hazards are associated with the environment and with a number of fire test response characteristics of materials, products, or assemblies including, but not limited to, ease of ignition, flame spread, rate of heat release, smoke generation and obscuration, toxicity of combustion products, and ease of extinguishment.

5.1.2 Fire hazard is defined in ISO 13943-2017 as:

5.1.2.1 *fire hazard*, *n*—potential for harm associated with fire.

5.1.2.2 *Discussion*—ISO 13943-2017 also states that, alternatively, fire hazard can be a physical object or condition with a potential for an undesirable consequence from fire.

5.1.2.3 ISO 13943-2017 defines fire hazard assessment (or fire hazard analysis) as “evaluation of the possible causes of fire (3.114), the possibility and nature of subsequent fire growth, and the possible consequences of fire.” It then states further that “other definitions of fire hazard assessment specifically point out a relationship to the (extent of) fire safety measures present or foreseen.” Terminology E176 does not define fire hazard assessment or fire hazard analysis.

5.1.3 Fire risk is defined in Terminology E176 as:

5.1.3.1 *fire risk*, *n*—an estimation of expected fire loss that combines the potential for harm in various fire scenarios that can occur with the probabilities of occurrence of those scenarios.

NOTE 2—Risk may be defined as the probability of having a certain type of fire, where the type of fire may be defined in whole or in part by the degree of potential harm associated with it or as potential for harm weighted by associated probabilities. However it is defined, no risk scale implies a single value of acceptable risk. Different individuals presented with the same risk situation may have different opinions on its acceptability.

5.1.4 Fire risk is defined in ISO 13943-2017, in a manner very similar to the definition in Terminology E176, as:

5.1.4.1 *fire risk*, *n*—estimation of expected fire loss that combines the potential for harm in various fire scenarios that can occur with the probabilities of occurrence of those scenarios.

5.1.4.2 *Discussion*—ISO 13943-2017 also states that, alternatively, fire risk is the “combination of the probability of a fire and a quantified measure of its consequence”.

5.2 The primary concern in the fire hazard assessment of electrotechnical products is to minimize the fire hazard resulting when such products ignite. Should a fire start, it is then desirable to limit the fire propagation. Give consideration to external events, such as the outbreak of a fire in the environment. In general, however, disregard deliberate misuse of an electrotechnical product, in the fire hazard assessment.

5.3 Give consideration also to heat release (both rate and amount) and opacity, toxicity, and corrosivity of the smoke from a burning product and any necessary ability to function under fire conditions. These hazards are directly related to the ignition and fire propagation. The emission of gases may also, under certain circumstances, lead to the possibility of explosion.

5.4 Certain electrotechnical products such as large enclosures, insulated cables, and conduits, may in fact replace large portions of surfaces and finishing materials of building construction or may penetrate fire-resisting walls. In these circumstances, the requirements for fire performance of the electrotechnical products, when exposed to an external fire, must ensure that they do not contribute to the hazard of fire to a greater degree than is permitted by the building materials or structures that are replaced.